

# BIOCHEMISTRY, PHD

Biochemistry is the study of biological molecules, their roles in the cell, and the chemistry of their reactions in living systems. The Integrated Program in Biochemistry (IPiB) is the merged graduate program between the Department of Biochemistry (in the College of Agricultural and Life Sciences) and the Department of Biomolecular Chemistry (in the School of Medicine and Public Health). The program trains the next generation of biochemists and prepares them for 21st-century challenges in science. IPiB offers a PhD degree with a major in biochemistry. Although an MS degree is officially offered, students are not admitted for a terminal master's degree.

From atoms and cells to plants and animals, biochemistry research in IPiB is at the forefront of modern science. We are home to around 100 graduate students and 56 world-class faculty pursuing cutting-edge research in all areas of biochemistry, including cell and developmental biology, chemical biology, endocrinology, enzymology, immunology, metabolism, molecular genetics, molecular medicine, physical biochemistry and biophysics, quantitative biology, structural biology, systems and synthetic biology, and virology. The program teaches critical thinking skills, applicable to a wide range of professional fields that students pursue after graduation.

The size and breadth of IPiB provide unique opportunities for graduate students who want to pursue a degree in one of the top biochemistry graduate programs in the nation. Our modern facilities are filled with labs carrying out groundbreaking research in a collaborative, friendly, and inspirational atmosphere. Welcome to IPiB, and we hope that you can share our enthusiasm for the biochemical sciences!

## DUAL DEGREES

The program participates with the School of Medicine and Public Health in offering a dual degree program for students wishing to complete both the MD and PhD degrees. For the prerequisites and degree requirements for the MD degree, as well as the online application form, see Medical Scientist Training Program (<http://mstp.med.wisc.edu/>).

## ADMISSIONS

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Please consult the table below for key information about this degree program's admissions requirements. The program may have more detailed admissions requirements, which can be found below the table or on the program's website.

Graduate admissions is a two-step process between academic programs and the Graduate School. **Applicants must meet the minimum requirements (<https://grad.wisc.edu/apply/requirements/>) of the Graduate School as well as the program(s).** Once you have researched the graduate program(s) you are interested in, apply online (<https://grad.wisc.edu/apply/>).

| Requirements    | Detail                                     |
|-----------------|--|
| Fall Deadline   | December 1                                 |
| Spring Deadline | This program does not admit in the spring. |
| Summer Deadline | This program does not admit in the summer. |

|                                    |  |
|------------------------------------|--|
| GRE (Graduate Record Examinations) | Not required.  |
| English Proficiency Test           | Every applicant whose native language is not English, or whose undergraduate instruction was not exclusively in English, must provide an English proficiency test score earned within two years of the anticipated term of enrollment. Refer to the Graduate School: Minimum Requirements for Admission policy: <a href="https://policy.wisc.edu/library/UW-1241">https://policy.wisc.edu/library/UW-1241</a> ( <a href="https://policy.wisc.edu/library/UW-1241/">https://policy.wisc.edu/library/UW-1241/</a> ). |
| Other Test(s) (e.g., GMAT, MCAT)   | n/a  |
| Letters of Recommendation Required | 3  |

To qualify for admission to the program, an applicant must complete a bachelor's degree at a regionally accredited college or university. The basic background for graduate study in biochemistry ordinarily would be provided by an undergraduate degree in biochemistry, chemistry, physics, or in one of the biological or medical sciences. The Admission Committee assesses a candidate's potential for success in the program by taking all aspects of their application into consideration. Most successful applicants have completed a rigorous undergraduate curriculum that includes courses in biology, chemistry, physics, and math. Most have also had a substantive laboratory experience that demonstrates commitment and talent for research. The applicant's undergraduate grade point average must be at least 3.0 (4.0 scale). For more information, please visit the Prospective Students ([https://ipib.wisc.edu/p\\_students.php](https://ipib.wisc.edu/p_students.php)) tab on the program's website.

## FUNDING

### FUNDING

#### GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (<https://grad.wisc.edu/funding/>) is available from the Graduate School. Be sure to check with your program for individual policies and restrictions related to funding.

#### PROGRAM RESOURCES

IPiB students receive a full stipend (<https://ipib.wisc.edu/education/financial-support/>) as well as tuition remission and comprehensive health insurance. The stipends take the form of traineeships, research assistantships, or fellowships, and are guaranteed for all IPiB PhD candidates in good academic standing and making satisfactory research progress. IPiB also assists its graduate students with outstanding academic records in competing for university or national awards.

## REQUIREMENTS

### MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (<http://guide.wisc.edu/graduate/>)

#policiesandrequirements text), in addition to the program requirements listed below.

## MAJOR REQUIREMENTS

### MODE OF INSTRUCTION

| Face to Face | Evening/<br>Weekend | Online | Hybrid | Accelerated |
|--------------|---------------------|--------|--------|-------------|
| Yes          | No                  | No     | No     | No          |

#### Mode of Instruction Definitions

**Accelerated:** Accelerated programs are offered at a fast pace that condenses the time to completion. Students typically take enough credits aimed at completing the program in a year or two.

**Evening/Weekend:** Courses meet on the UW–Madison campus only in evenings and/or on weekends to accommodate typical business schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.

**Face-to-Face:** Courses typically meet during weekdays on the UW–Madison Campus.

**Hybrid:** These programs combine face-to-face and online learning formats. Contact the program for more specific information.

**Online:** These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

## CURRICULAR REQUIREMENTS

### Requirement Detail

Minimum Requirement 54 credits

Minimum Residence Requirement 42 credits

Minimum Graduate Coursework Requirement 54 credits must be graduate-level coursework. Refer to the Graduate School: Minimum Graduate Coursework (50%) Requirement policy: <https://policy.wisc.edu/library/UW-1244> (<https://policy.wisc.edu/library/UW-1244/>).

Overall Graduate GPA Requirement 3.00 GPA required. Refer to the Graduate School: Grade Point Average (GPA) Requirement policy: <https://policy.wisc.edu/library/UW-1203> (<https://policy.wisc.edu/library/UW-1203/>).

Other Grade Requirements n/a

Assessments and Examinations Deposit of the doctoral dissertation in the Graduate School is required.

Language Requirements n/a

**Graduate School Breadth Requirement** Doctoral students must complete the program's required coursework plus a minimum of 6 credits of approved breadth coursework in the physical, biological, and/or quantitative sciences (3 credits each from two of these categories). Students who opt for the Option A or B doctoral minor or a graduate/professional certificate must complete the program's required coursework, the requirements of the minor or certificate program, and a minimum of 6 credits of approved breadth coursework in the physical, biological, and/or quantitative sciences. The latter might be waived with approval from the Education and Career Development Committee.

## REQUIRED COURSES

| Code   | Title   | Credits   |
|--|---|-----------|
| <b>Program Course Requirements</b>   |   |           |
| BIOCHEM/<br>BMOLCHEM 701   | Responsible Conduct in Bioscience Research (taken fall of first year)   | 2         |
| BIOCHEM 719  | From Atoms to Molecules (taken fall of first year)  | 3         |
| BMOLCHEM 720   | Experimental Design and Paradigms in Cellular Biochemistry and Molecular Biology (taken spring of first year) | 3         |
| BIOCHEM 721  | Biochemical Communication (taken fall of second year)   | 2         |
| <b>Research Requirements</b>   |   | <b>33</b> |
| BIOCHEM 990  | Research  |           |
| BMOLCHEM 990   | Advanced Biomolecular Chemistry and Research  |           |
| <b>Breadth Requirements</b>  |   | <b>6</b>  |
| Students must complete a minimum of two additional graduate-level (Grad 50%) courses from the following list of didactic or laboratory courses in order to fulfill their breadth requirements, and a minimum of 6 total credits is required. In consultation with their committee, students must complete courses from at least 2 of the following categories: physical sciences, biological sciences, or quantitative sciences. One-credit seminars do not count toward the breadth requirements. |   |           |
| BIOCHEM/<br>NUTR SCI 510   | Nutritional Biochemistry and Metabolism   |           |
| BIOCHEM 570  |   |           |
| BIOCHEM/<br>M M & I 575  | Biology of Viruses  |           |
| BIOCHEM 601  | Protein and Enzyme Structure and Function   |           |
| BIOCHEM/B M I/<br>BMOLCHEM/<br>MATH 609  | Mathematical Methods for Systems Biology  |           |
| BIOCHEM/<br>GENETICS/<br>MICROBIO 612  | Prokaryotic Molecular Biology   |           |
| BIOCHEM/<br>NUTR SCI 619   | Advanced Nutrition: Intermediary Metabolism of Macronutrients   |           |
| BIOCHEM/<br>GENETICS/<br>MD GENET 620  | Eukaryotic Molecular Biology  |           |

|  |  |
|--|--|
| BIOCHEM/<br>BOTANY 621                                     | Plant Biochemistry   |
| BIOCHEM 625  | Mechanisms of Action of Vitamins and Minerals  |
| BIOCHEM/<br>NUTR SCI 645                                   | Molecular Control of Metabolism and Metabolic Disease  |
| BMOLCHEM/<br>MICROBIO 668                                  | Microbiology at Atomic Resolution  |
| BMOLCHEM 675   | Advanced or Special Topics in Biomolecular Chemistry (Topic: Biochemical Methods for Genome Maintenance)   |
| BIOCHEM/<br>CHEM 704                                       | Chemical Biology   |
| BIOCHEM 719  | From Atoms to Molecules  |
| BMOLCHEM 720   | Experimental Design and Paradigms in Cellular Biochemistry and Molecular Biology   |
| BIOCHEM 721  | Biochemical Communication  |
| BIOCHEM 729  | Advanced Topics (Topics: Membrane Protein Structure and Function (Advanced); Foundations of Biotechnology; Biochemical Applications of Nuclear Magnetic Resonance) |
| STAT/<br>F&W ECOL 571                                      | Statistical Methods for Bioscience I   |
| MICROBIO 607   |  |
| NTP/<br>NEURODPT 610                                       | Cellular and Molecular Neuroscience  |
| B M E/<br>MED PHYS/<br>PHMCOL-<br>M/PHYSICS/<br>RADIOL 619 | Microscopy of Life   |
| CHEM/<br>GENETICS 626                                      | Genomic Science  |
| CHEM 665   | Biophysical Chemistry  |
| CRB 630  | Proteomics Approaches for Biologists   |
| CRB 640  | Fundamentals of Stem Cell and Regenerative Biology   |
| ONCOLOGY/<br>M M & I/<br>PL PATH 640                       | General Virology-Multiplication of Viruses   |
| MICROBIO 657   | Bioinformatics for Microbiologists   |
| CHEM 668   | Biophysical Spectroscopy   |
| NTP 670  |  |
| ONCOLOGY 673   | Purification and Characterization of Protein and Protein Complexes   |
| NEURODPT 675   | Selected Topics in Physiology  |
| ONCOLOGY 703   | Carcinogenesis and Tumor Cell Biology  |
| PATH 750   | Cellular and Molecular Biology/ Pathology  |
| PATH 751   | Biology of Aging   |

|                        |   |
|------------------------|---|
| B M I/<br>COMP SCI 776 | Advanced Bioinformatics   |
| ONCOLOGY 778           | Bioinformatics for Biologists   |
| B M E 780              | Methods in Quantitative Biology   |
| PHMCOL-M 781           | Molecular and Cellular Principles in Pharmacology   |
| CBE/B M E 783          | Design of Biological Molecules  |
| B M I 826              | Special Topics in Biostatistics and Biomedical Informatics (Topic: Computational Network Biology) |
| BOTANY 860             | Plant Cell Biology  |
| LSC 875                | Special Topics  |
| GENETICS 885           | Advanced Genomic and Proteomic Analysis   |

### Seminar Requirement 5

PhD students must take at least five semesters of seminars and present in three of those. Students select 1-credit seminars in consultation with their committee.

### Total Credits 54

## POLICIES

### GRADUATE SCHOOL POLICIES

The Graduate School's Academic Policies and Procedures (<https://grad.wisc.edu/acadpolicy/>) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

### MAJOR-SPECIFIC POLICIES

#### PRIOR COURSEWORK

##### Graduate Credits Earned at Other Institutions

For well-prepared advanced students, the program may accept up to 12 credits of prior graduate coursework from an uncompleted degree from other institutions towards the minimum graduate degree credit and minimum graduate coursework (50%) requirement. The minimum graduate residence credit requirement can be satisfied only with courses taken as a graduate student at UW-Madison.

##### Undergraduate Credits Earned at Other Institutions or UW-Madison

No credits from a UW-Madison undergraduate degree are allowed to transfer toward the graduate degree.

##### Credits Earned as a Professional Student at UW-Madison (Law, Medicine, Pharmacy, and Veterinary careers)

Refer to the Graduate School: Transfer Credits for Prior Coursework (<https://policy.wisc.edu/library/UW-1216/>) policy.

##### Credits Earned as a University Special Student at UW-Madison

No credits taken as a University Special student are allowed to transfer toward the graduate degree.

## PROBATION

Refer to the Graduate School: Probation (<https://policy.wisc.edu/library/UW-1217/>) policy.

## ADVISOR / COMMITTEE

Every graduate student must have a faculty thesis advisor in the program. The thesis advisor advises the student about coursework, supervises the student's research, and acts as a mentor to the student through the student's graduate career. The thesis advisor must approve the student's coursework before registration for a given semester and must also approve any subsequent changes to it.

A PhD thesis committee is composed of at least four graduate University faculty members, including the thesis advisor. The thesis committee is empowered by the program to advise the student about certification, administer the preliminary examination, oversee annual progress reports, approve thesis composition, and conduct the final PhD examination.

## CREDITS PER TERM ALLOWED

A maximum of 12 credits in fall and spring semesters and 2 credits in summer semesters is permitted for non-dissertators; 3 credits in fall, spring, and summer semesters for dissertators.

## TIME LIMITS

Refer to the Graduate School: Time Limits (<https://policy.wisc.edu/library/UW-1221/>) policy.

## GRIEVANCES AND APPEALS

These resources may be helpful in addressing your concerns:

- Bias or Hate Reporting (<https://doso.students.wisc.edu/bias-or-hate-reporting/>)
- Graduate Assistantship Policies and Procedures (<https://hr.wisc.edu/policies/gapp/#grievance-procedure>)
- Hostile and Intimidating Behavior Policies and Procedures (<https://hr.wisc.edu/hib/>)
  - Office of the Provost for Faculty and Staff Affairs (<https://facstaff.provost.wisc.edu/>)
- Employee Assistance (<http://www.eao.wisc.edu/>) (for personal counseling and workplace consultation around communication and conflict involving graduate assistants and other employees, post-doctoral students, faculty and staff)
- Employee Disability Resource Office (<https://employeedisabilities.wisc.edu/>) (for qualified employees or applicants with disabilities to have equal employment opportunities)
- Graduate School (<https://grad.wisc.edu/>) (for informal advice at any level of review and for official appeals of program/departmental or school/college grievance decisions)
- Office of Compliance (<https://compliance.wisc.edu/>) (for class harassment and discrimination, including sexual harassment and sexual violence)
- Office Student Assistance and Support (OSAS) (<https://osas.wisc.edu/>) (for all students to seek grievance assistance and support)
- Office of Student Conduct and Community Standards (<https://conduct.students.wisc.edu/>) (for conflicts involving students)
- Ombuds Office for Faculty and Staff (<http://www.ombuds.wisc.edu/>) (for employed graduate students and post-docs, as well as faculty and staff)

- Title IX (<https://compliance.wisc.edu/titleix/>) (for concerns about discrimination)

## College of Agricultural and Life Sciences: Grievance Policy

In the College of Agricultural and Life Sciences (CALs), any student who feels unfairly treated by a member of the CALs faculty or staff has the right to complain about the treatment and to receive a prompt hearing. Some complaints may arise from misunderstandings or communication breakdowns and be easily resolved; others may require formal action. Complaints may concern any matter of perceived unfairness.

To ensure a prompt and fair hearing of any complaint, and to protect the rights of both the person complaining and the person at whom the complaint is directed, the following procedures are used in the College of Agricultural and Life Sciences. Any student, undergraduate or graduate, may use these procedures, except employees whose complaints are covered under other campus policies.

1. The student should first talk with the person at whom the complaint is directed. Most issues can be settled at this level. Others may be resolved by established departmental procedures.
2. If the student is unsatisfied, and the complaint involves any unit outside CALs, the student should seek the advice of the dean or director of that unit to determine how to proceed.
  - a. If the complaint involves an academic department in CALs the student should proceed in accordance with item 3 below.
  - b. If the grievance involves a unit in CALs that is not an academic department, the student should proceed in accordance with item 4 below.
3. The student should contact the department's grievance advisor within 120 calendar days of the alleged unfair treatment. The departmental administrator can provide this person's name. The grievance advisor will attempt to resolve the problem informally within 10 working days of receiving the complaint, in discussions with the student and the person at whom the complaint is directed.
  - a. If informal mediation fails, the student can submit the grievance in writing to the grievance advisor within 10 working days of the date the student is informed of the failure of the mediation attempt by the grievance advisor. The grievance advisor will provide a copy to the person at whom the grievance is directed.
  - b. The grievance advisor will refer the complaint to a department committee that will obtain a written response from the person at whom the complaint is directed, providing a copy to the student. Either party may request a hearing before the committee. The grievance advisor will provide both parties a written decision within 20 working days from the date of receipt of the written complaint.
  - c. If the grievance involves the department chairperson, the grievance advisor or a member of the grievance committee, these persons may not participate in the review.
  - d. If not satisfied with departmental action, either party has 10 working days from the date of notification of the departmental committee action to file a written appeal to the CALs Equity and Diversity Committee. A subcommittee of this committee will make a preliminary judgement as to whether the case merits further investigation and review. If the subcommittee unanimously determines that the case does not merit further investigation and review, its decision is final. If one or more members of the subcommittee determine that the case does merit further investigation and review, the subcommittee will investigate and

seek to resolve the dispute through mediation. If this mediation attempt fails, the subcommittee will bring the case to the full committee. The committee may seek additional information from the parties or hold a hearing. The committee will present a written recommendation to the dean who will provide a final decision within 20 working days of receipt of the committee recommendation.

- If the alleged unfair treatment occurs in a CALS unit that is not an academic department, the student should, within 120 calendar days of the alleged incident, take his/her grievance directly to the Associate Dean of Academic Affairs. The dean will attempt to resolve the problem informally within 10 working days of receiving the complaint. If this mediation attempt does not succeed the student may file a written complaint with the dean who will refer it to the CALS Equity and Diversity Committee. The committee will seek a written response from the person at whom the complaint is directed, subsequently following other steps delineated in item 3d above.

## OTHER

All students, both US and international, receive an annual stipend and tuition remission for the duration of their studies, provided satisfactory progress is made toward their degree. Comprehensive medical coverage is also offered. In addition, some students are supported on fellowships or training grants. Students are chosen based on criteria specified by the different training grants.

Students may matriculate only in the fall semester.

## PROFESSIONAL DEVELOPMENT

### PROFESSIONAL DEVELOPMENT GRADUATE SCHOOL RESOURCES

Take advantage of the Graduate School's professional development resources (<https://grad.wisc.edu/pd/>) to build skills, thrive academically, and launch your career.

## LEARNING OUTCOMES

### LEARNING OUTCOMES

- Gain a broad understanding of the biochemical principles that underlie all biological processes.
- Become aware of the current limitations of the state of understanding of this discipline and the strategies that are required to advance the field.
- Formulate and design new approaches that extend and apply biochemical principles beyond their current boundaries.
- Conduct independent research using a diverse breadth of biochemical processes.
- Think critically to address research challenges using a broad range of the theories, research methods, and approaches to scientific inquiry.
- Collaborate with investigators within the program, university, and beyond since current and future advances in the biomolecular sciences demand interdisciplinary skills.
- Foster professional and ethical conduct in the sciences, including but not limited to: exposition of the scientific method; ethical design of experimental protocols; reproducibility in science; professional behavior in industrial, government, and academic

settings; documentation of scientific results; communication to other scientists and the public; peer review; and confidentiality.

- Develop communications skills that enable the articulation of research to fellow scientists and non-scientists.
- Explore career development opportunities in industry, government and academia to realize professional goals and paths.
- Develop teaching and mentoring skills in both lecture and laboratory settings.

## PEOPLE

### PEOPLE

**Faculty:** Professors B. Fox (Chair, Department of Biochemistry), Kiley (Chair, Department of Biomolecular Chemistry), Amasino, Attie, Audhya, Bednarek, Brow, Buller, Butcher, Campbell, Cantor, Cavagnero, Chaudhari, Coon, Cox, Coyle, Craciun, Craig, Denu, Engin, Fan, C. Fox, Friesen, Galmozzi, Gellman, Gisriel, Grant, Harrison, Henzler-Wildman, Hess, Holden, Hoskins, Hull, Keck, Kirchoerfer, Landick, Lewis, Lim, Merrins, Neugebauer, Ntambi, Putnam, Raman, Rayment, Rienstra, Romero, Senes, Sheets, Simcox, Sussman, Venturelli, Wang, Weeks, Wright, Xu